

at elevations now occupied only by the yak and similar mountain forms.

In reference to the greater richness of the Siwalik fauna, as contrasted with the Indian fauna of the present day, he quotes with approval the suggestion of Mr. Wallace, that a sweeping reduction was brought about by the cold of the glacial period. Of the influence of this cold in India, there are abundant proofs in the great extension of the Himalayan glaciers, for instance, in Sikkim and Kashmir, down to 6,000 feet and 8,000 feet above sea-level; and in the Naya hills of Assam, whose greatest elevation does not exceed 10,000 feet, in the large moraines at 4,500 feet, described by Col. Godwin Austen.

The oldest proofs of man's occupation hitherto met with in India, are a chipped axe or scraper, in the alluvial (post-pliocene) deposits of the Narbada, associated with remains of *Ursus*, *Elephas*, *Rhinoceros*, *Hippopotamus*, *Tetraprotodon*, and *Bos*, all of extinct species; and a flake, apparently of human manufacture, in the Godavari gravels of similar age. Quartzite implements of the palaeolithic type are abundant in the laterite gravels of Madras, but these are probably of later date. Axes of neolithic type have as yet been met with only on the surface, most abundantly in the Banda district of the North-West Provinces.

The Manual is illustrated by twenty-one admirably executed lithographed plates of characteristic fossil forms, and a few woodcuts of sketches and sections. Its utility for purposes of reference is rendered all that can be desired by a copious and well-arranged index. We confidently hope that the publication of the work will give an impulse to the advancement of Indian geology by adding largely to the number of non-professional workers, a class which has hitherto been singularly wanting in India, despite the examples of such men as Carter, Forbes, Newbold, Strachey, and Hislop.

H. F. B.

LETTERS TO THE EDITOR

[The Editor does not hold himself responsible for opinions expressed by his correspondents. Neither can he undertake to return, or to correspond with the writers of, rejected manuscripts. No notice is taken of anonymous communications.]

[The Editor urgently requests correspondents to keep their letters as short as possible. The pressure on his space is so great that it is impossible otherwise to ensure the appearance even of communications containing interesting and novel facts.]

Prof. Clifford's Mathematical Papers

HAVING, at the request of Mrs. Clifford and Dr. Spottiswoode, undertaken the editing of the late Prof. Clifford's mathematical papers, I am anxious to secure the co-operation of all mathematicians who are interested in the matter. Prof. Clifford does not appear to have been in the habit of widely distributing copies of his writings, so I have found of many of them a great number of copies, whilst of others I have not come across a single one. I will first state what I have:—

All papers in the *Phil Trans.*, in the *Proceedings of the London Mathematical Society*, in the *Messenger of Mathematics*, in the *Manchester Transactions*, in the *Cambridge Philosophical Society's Journals*, in the *South Kensington Handbook*, in the *Mathematical Reprint* from the *Educational Times*.

Of the papers in the *Quarterly Journal of Mathematics* I have only §§ 1-11, 17-23, of the *Analytical Metrics*. I should be glad also to have a copy of the *Academy* for August 15, 1873, and information about "Lecture Notes" on Geometry. These last are lithographed and are comprised in twenty-six articles (fall), of which I lack one page, containing § 19-21. I need hardly add I shall be glad to receive any other papers (mathematical)

which are not contained in the above-named journals. The *NATURE* article (translation of Riemann) I have. I have Mrs. Clifford's permission to distribute the author's copies of her late husband's papers to mathematicians who may wish to have them.

R. TUCKER

27, Cantlowes Road, Camden Square, N.W.

Pine-Pollen mistaken for Flowers of Sulphur

THE following paragraph appeared in the *Times* of June 16:—

"During the past week, after heavy rain, a thin film of sulphur has been observed at Windsor, Slough, and in the neighbourhood generally, to settle upon the surface of rain-water caught in butts and cisterns. The phenomenon at first did not attract much attention, but being observed on different occasions it has given rise to much speculation as to the cause of it, there being no manufactures in the neighbourhood at all likely to have produced it. It has been suggested that a sulphureous vapour may have been wafted to this country by the recent south-east winds, and arrested and deposited in the rain."

The supposed "sulphur rain," a fine yellow dust, was the cause of great excitement among the country people in this neighbourhood. It was first observed on the afternoon of Sunday, June 8, after a remarkably heavy shower, and much disturbed the inhabitants of some of the villages round Eton, who fancied that it smelt "awful like brimstone," of which its yellow colour was somewhat suggestive. In some places it gave rise to such a feeling of fright that the people were afraid to go to bed, thinking that the judgment day was at hand! Two or three days afterwards there was another "sulphur" shower, and I collected a quantity of the dust with my pupils, who were at work with me in my laboratory at the time. One of them, H. Bury, immediately recognised its resemblance to the pollen of *Pinus pinaster*, with which he is familiar from its abundance in the neighbourhood of his home at Bournemouth; and we have none of us any doubt but that this so-called sulphur is the pollen of this tree or of the Scotch fir, *Pinus sylvestris*, both of which are common in Windsor Forest. Two of the Windsor doctors, both practised microscopists, at once came to the same conclusion; but a local chemist and druggist is said (on good authority) to have supported the sulphur theory. This, perhaps, accounts for the rather positive statement by the Windsor correspondent of the *Times* as to the nature of the deposit, and also for the suggestion he refers to respecting its origin, which explains the phenomenon in a manner that is certainly more curious than probable, from a chemical point of view. I bear that the "sulphureous vapour" is supposed to have been "wafted to this country," after escaping from Etna during the recent eruptions, which fortunately occurred at just the right time to give apparent probability to the sulphur theory.

Thinking that such a remarkable phenomenon should not be allowed to pass unnoticed, I sent a short note to the *Times* of the 17th inst., stating the real (pollen) nature of the yellow dust, hoping that this would set the matter at rest and dispel the superstitious fears of the rustics. I was therefore greatly surprised, a few days afterwards, at receiving a letter from an F.R.G.S. residing near Carlow, in Ireland, who had seen my note in the *Times*, but nevertheless spoke of an "extensive fall of sulphur" in his neighbourhood. He was good enough to inclose me a "specimen of its encrustations" on a dead leaf, and said that "till yesterday's heavy rains any quantity of leaves like that I send you might have been gathered, and the edges of the pools of water were heavily incrusted with pure sulphur." He added that he thought I should not find the deposit to be "the produce of *Pinus pinaster*." This, of course, was rather startling, for I naturally supposed that no one would write so confidently who had not satisfied himself by chemical tests and by microscopical examination as to the truth of his statements, especially after hearing of the mistake which had been made in England. A glance at the deposit under the microscope, however, revealed its true nature—pine-pollen again!

I wrote accordingly to my informant, telling him this and sending him some pollen taken directly from the tree, so that he might recognise its similarity to the "pure sulphur" he so kindly sent me. I hope that by this time he has done so.

The above facts are of interest, partly as affording an excellent illustration of the transportation of pollen by the wind, and partly because they show how ready some people are to attribute an almost miraculous origin to anything a trifle out of the com-

mon, which could be readily explained by any one possessing a little elementary knowledge of science.

P. HERBERT CARPENTER

The Museum, Eton College, June 21

Intellect in Brutes

IN NATURE, vol. xx. p. 147, Mr. H. D. Barclay writes:—"The fact that a cat or a dog subject their food to examination before eating it, does not, most assuredly, prove the possession of abstract powers of thought in the animal. Mr. Romanes here says:—'The motive of the examination being to ascertain which general idea of quality is appropriate to the particular object examined.'

"Here he attributes to an animal whose nature he does not fully understand, his own process of thought, and this appears to me to be a constant source of error in the investigation of animal psychology. That brutes possess self-consciousness, introspection, imagination, abstract thought, cannot, I think, be proved. The fact that animals possess faculties differing from those of man is an insuperable obstacle to a perfect analysis of their intelligences.

"Name these faculties as you please, call them 'inherited habit,' 'inherited memory,' it is perfectly certain that man does not possess them."

Now, far from it being "perfectly certain" that animals possess mental faculties differing in kind from our own, it seems to me that, if we except the so-called "homing instinct" as a faculty about which as yet we know very little, it is "perfectly certain" that there is no other faculty presented by brutes which is not also presented by man. It is the converse proposition that is more difficult to combat—viz., that man possesses faculties of mind which appear at first sight to differ in kind from anything that is presented by animals. Therefore, while I should deem it almost superfluous to "prove" that man possesses "instincts" or "inherited habits" in common with animals, I have never attempted to "prove" that animals possess "self-consciousness" or "introspection" in common with man. Indeed, if Mr. Barclay will again read my article in NATURE, he will see that I expressly state my belief that these, the highest faculties of mind, may be, as the theory of evolution would lead us to expect they ought to be, confined to the highest product of psychological development.

As regards the illustration to which Mr. Barclay objects, I may observe that I selected it for the express purpose of disarming the criticism which he advances. Had I chosen for an illustration some "general idea of quality" more abstract than that of "good for eating or bad for eating," I could better have understood a critic accusing me of attributing to animals my "own process of thought" in the regions of self-conscious introspection. But seeing that I do not myself require or perform any process of introspective thought in order to reject a rotten egg or to regale myself on good roast beef, I cannot understand why I should not attribute to an animal precisely the same general ideas of "good for eating and bad for eating" that in my own case I know to be the causes of my acting precisely as I see animals act. The truth is that in speaking of general or abstract ideas we are not careful enough to discriminate between those simple ideas of quality which spring from mere sensuous associations, and those more elaborated ideas which spring from the more complex associations that are supplied by "mental reflection." But although it is of importance to remember that there is thus a great distinction between these two orders of abstract ideas, it is of no less importance to remember that both orders belong to the same class—all such ideas having reference to quality as abstracted from particular objects of perception, and the only difference between those of the one order and those of the other consisting in the higher degree of elaboration which is supplied to our abstractions by the power of thinking about our thoughts. On the whole, therefore, I maintain that it can be "proved" that animals "possess abstract thought" of the inferior order which I have explained, and the phenomena of dreaming which is presented by several animals would seem sufficient proof that some animals, at least, possess a tolerably well-developed "imagination."

GEORGE J. ROMANES

I HAVE been reading with great interest the letters and discussions lately published in NATURE, on intellect in brutes. However, in none of them have I found any notice of a dog

recognising a painted likeness of his master or any member of the family. I have seen, in other publications on this subject, that "this is one of the things a dog has never been known to do." During my residence in Cornwall I had a most intelligent and faithful dog for fifteen years. I had him when a month old. His mother was a beautiful liver-coloured spaniel, rather large; his father a black Newfoundland; my dog took after him in colour and shape.

In 1843 a young and self-taught artist asked me to allow him to paint my likeness in oil colours, and I consented. His studio was in the next town, three miles distant, and as often as required I went over; I, however, did not take my dog with me. It was done in Kit-cat size; and he succeeded so well in the likeness and artistic work, that when exhibited at the annual meeting of the Polytechnic Society at Falmouth, a medal was awarded to it, and, as well, it was "highly commended." Not only this, it brought him into notice and gained him lots of employment. The artist was so grateful for my attention that he presented me with the painting, and I still have it. When it was brought to my house, my old dog was present with the family at the "unveiling"; nothing was said to him nor invitation given him to notice it. We saw that his gaze was steadily fixed on it, and he soon became excited, and whined, and tried to lick and scratch it, and was so much taken up with it that we—although so well knowing his intelligence—were all quite surprised; in fact, could scarcely believe that he should know it was my likeness. We, however, had sufficient proof after it was hung up in our parlour; the room was rather low, and under the picture stood a chair; the door was left open without any thought about the dog; he, however, soon found it out, when a low whining and scratching was heard by the family, and on search being made, he was in the chair trying to get at the picture. After this I put it up higher, so as to prevent it being injured by him. This did not prevent him from paying attention to it, for whenever I was away from home, whether for a short or long time—sometimes for several days—he spent most of his time gazing on it, and as it appeared to give him comfort the door was always left open for him. When I was long away he made a low whining, as if to draw attention to it. This lasted for years, in fact as long as he lived, and was able to see it. I have never kept a dog since he died, I dare not—his loss so much affected me. I might tell of many of his wonderful actions; he could do most of such things as are related of other dogs. I am now only anxious to notice this recognition of my likeness, from never having heard of another such fact being recorded of any other dog.

Edinburgh

CHAS. W. PEACH

A CASE somewhat similar to that mentioned by Dr. Frost, of a cat scattering crumbs, occurred here within my own knowledge.

During the recent severe winter a friend was in the habit of throwing crumbs for birds outside his bedroom window. The family have a fine black cat, which, seeing that the crumbs brought birds, would occasionally hide herself behind some shrubs, and when the birds came for their breakfast, would pounce out upon them with varying success. The crumbs had been laid out as usual, one afternoon, but left untouched, and during the night a slight fall of snow occurred. On looking out next morning my friend observed Puss busily engaged scratching away the snow. Curious to learn what she sought, he waited, and saw her take the crumbs up from the cleared space and lay them one after another on the snow. After doing this she retired behind the shrubs to wait further developments. This was repeated on two other occasions, until finally they were obliged to give up putting out crumbs, as Puss showed herself such a fatal enemy to the birds.

GREENOCK

June 23

Aquarium Notes

Marine Copepoda—The lump-sucker.—In the salt water tanks of the Edinburgh Aquarium at the present date may be seen an immense number of white specks flitting rapidly through the water, after the fashion of the familiar *Cyclops* and its neighbours in fresh streams. On subjecting these "tenants at will" of the tanks to microscopic scrutiny, they are seen to belong to the Entomostracous division of the crustacea, and may in all probability be classified in the cyclops-family, as near kith and kin of the well-known "fresh-water flea." The cephalothorax